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ABSTRACT TITLE: Challenges to the application of IPMC as actuators of planetary mechanisms

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ABSTRACT TEXT
Ion-exchange membrane metallic composites (IPMC), which were first reported in 1992, are one of the electroactive materials (EAP) that were shown to have potential applications as actuators. The recent introduction of perfluorocarboxylate-gold composite with tetra-n-butylammonium and lithium cations instead of sodium made the most significant improvement of the material's electroactivity. Under less than 3 volts, such IPMC materials were shown to induce bending beyond a complete loop. The bending characteristics of IPMC proved ideal as an actuator of a dust wiper for planetary applications. Specifically, a dust-wiper is being developed as a flight-like device for the Nanorover's infrared camera window of the MUSES-CN mission. This joint NASA and the Japanese space agency mission, is scheduled to be launched from Kagoshima, Japan, in January 2002, to explore the surface of a small near-Earth asteroid. However, application of EAP at space conditions is a great challenge due to harsh operating conditions and the critical needs in robustness and durability. Several issues that are critical to the operation of IPMC are addressed including the operation in vacuum, low temperatures, and the effect of the electromechanical characteristics of the IPMC on its actuation capability. Highly efficient IPMC materials, mechanical modeling, unique elements and protective coatings were introduced by the authors and are making a high probability for success of the IPMC actuated dust-wiper.

KEY WORDS: Electroactive Polymers, Planetary Applications, Artificial Muscles, Dust Wiper.

BRIEF BIOGRAPHY: Dr. Yoseph Bar-Cohen is a physicist with over 28 years experience in NDE, sensors, actuators and electroactive materials. He is the Jet Propulsion Lab (JPL) Resident NDE expert and the Group Leader for the NDE& Advanced Actuators (NDEAA) Technologies. Also, he is an Adjunct Professor at the Department of the Mechanical and Aerospace Engineering, the University of California, Los Angeles (UCLA), a Fellow of the American Society for NDT (ASNT) and Chair of the ASNT's Ultrasonic Committee. Dr. Bar-Cohen is leading a NASA task to develop applications for EAP materials. Some of his contributions include his discoveries the leaky Lamb waves and the polar backscattering in composite materials and co-pioneered their applications to NDE. He is the author of more than 170 publications, made numerous presentations at national and international symposia and holds many patents.